Abstract

Information can be encoded in the state of a physical system and computation is a task of information processing that can be performed with a physically realizable device Since the physical world is fundamentally quantum mechanical, one would expect that the foundations of information processing issues such as computability etc , should be sought in quantum mechanics In its usual form, the Turing machine model handles information in units called bits However, in a quantum world, the elementary unit of information is a qubit Can we derive any advantage in computing if we represent information in qubits? This was the question asked by Richard Feynman in 1982 He speculated that it would indeed be advantageous This laid the foundations for a new paradigm Quantum Computing Since then, we have come to know that the quantum computer, as an abstract model of computation, is more powerful than ordinary computers

This thesis reviews the main concepts and results in the field of quantum computing along with a brief look at the related field of reversible computing The specific research contributions made in this thesis include a linear depth circuit simulation of quantum Turing machines, an improvement over the previously known quadratic depth, we construct a quantum push down automaton that accepts a class of languages that contains some non CFLs, we prove that a reversible (probabilistic) push down automaton is no more powerful than a deterministic (probabilistic) finite automaton